Amendment to the Claims

By the above,

1. independent claim 1 has been rewritten to improve its form and to make more clear the invention which Applicant regards as his invention,

2. claim 7 has been rewritten in independent form and includes no new limitations, and

3. claims 24-27 have been added to more fully and completely claim the disclosed subject matter.

More specifically, claim 1 has been rewritten to require "a low density slurry bridge mix comprising about 25 to about 35 composition weight percent zirconium; about 10 to about 20 composition weight percent thermal conductivity enhancer; about 45 to about 65 composition weight percent potassium perchlorate oxidant; and about 1.5 to about 5.0 composition weight percent binder material." Such limitations find support through the original application such as at page 13, line 7 through page 14, line 16, for example.

Newly added claims 24-27 generally correspond to original claims 8-11 but are dependent on claim 7, rather than claim 1.

Claims 1-27 remain in the application.

Before addressing the various prior art grounds of rejection, a brief review of the background leading to the subject invention development is believed helpful and desirable.

This invention relates generally to bridge mix materials such as for use in an initiator such as for an inflator device for an inflatable restraint system and, more particularly, to low density slurry bridge mix materials that may more readily adhere to a bridgewire.

One metal-oxidant bridge mix commonly used in automotive initiators includes a pyrotechnic composition containing a mixture of zirconium metal and potassium perchlorate with a polymeric binder, generally referred to as a ZPP mixture or composition. For various reasons discussed in greater detail in the application, in order for such a ZPP mixture to function properly, the ZPP mixture is typically deposited on a bridgewire and then compacted to a high percentage of its theoretical density, e.g., about 80 to about 95 percent of theoretical density, in order to satisfy stringent initiator sensitivity requirements. As set forth in the application, initiators containing such ZPP mixtures are typically produced by welding a charge holder cup to a header, which header is ground flat to within a fraction of the diameter of the bridgewire in order to protect and support the bridgewire during compression of the ZPP mixture. As will be appreciated, undesirable expense is added to the production

of such typical ZPP containing initiators due to the need to provide a charge holder to contain the ZPP mixture and the need to appropriately grind the header to provide sufficient support and protection for the bridgewire.

The present invention provides a low density slurry bridge mix including zirconium, potassium perchlorate, a thermal conductivity enhancer and a binder material for use in an initiator, such as for an inflator device for an inflatable restraint system. Advantageously, the invention avoids or minimizes the need for bridge mix compression and other manufacturing steps, as well as the use of additional parts to contain the bridge mix, while also satisfying industry initiator sensitivity requirements such as the All Fire (AF) and No Fire (NF) standards and satisfying manufacturing criteria such as relating to cost and ease of manufacturing, for example. Moreover, it has been unexpectedly discovered that the inclusion of a thermal conductivity enhancer in such a bridge mix results in a proportionately greater increase in the NF rating without an undesirable increase in the AF rating. Previous experience had indicated that inclusion of thermal conductivity enhancers would result in approximately equivalent increases in both the NF and AF ratings. (See Application, page 11, line 17 through page 12, line 21.)

Claim Rejections - 35 U.S.C. §103

1. Claims 1-5 and 8-11 have been rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent 3,570,403 to Hawley (hereinafter "Hawley") in view of U.S. Patent 4,869,170 to Dahmberg et al. (hereinafter "Dahmberg") and U.S. Patent 5,889,228 to Ewick et al. (hereinafter "Ewick").

The Action cites Hawley as disclosing an initiating mixture for use with a bridgewire that comprises zirconium and potassium perchlorate with a resin binder. The Action acknowledges that Hawley does **NOT** disclose the density of the mixture, the amounts of the components or the addition of copper oxide or aluminum.

The Action cites Dahmberg as teaching an initiating mixture for use with a bridgewire that comprises a mixture of copper oxide and aluminum.

The Action cites Ewick as teaching that ignition charges can have a lower density such as 49-65% of its theoretical maximum density and be used with a bridgewire.

The Action asserts that it would have been obvious one having ordinary skill in the art at the time the invention was made to mix together the igniter mixture disclosed by Hawley with igniter mixture disclosed by Dahmberg. The Action subsequently asserts that it would have been obvious to vary the amounts of metals and oxidizers to achieve a desired result.

Such rejections are respectfully traversed to the extent that it might be contended that these rejections apply to the pending claims as rewritten above.

Claim 1 is an independent claim directed to a low density slurry bridge mix including about 25 to about 35 composition weight percent zirconium metal, about 10 to about 20 composition weight percent thermal conductivity enhancer, about 45 to about 65 composition weight percent potassium perchlorate oxidant, and about 1.5 to about 5.0 composition weight percent binder material, said low density slurry bridge mix having a dry density of about 45% to about 65% of theoretical density. Such a low density slurry bridge mix is clearly not shown or suggested by Hawley as, for example, Hawley does not disclose or suggest a low density slurry bridge mix including a thermal conductivity enhancer such as aluminum or copper oxide, the amounts of the components and the density of the mixture as acknowledged in the Action. Further, Hawley does not disclose the use of thermal conductivity enhancers such as magnesium, tungsten, gold, silver and palladium oxides, and combinations thereof.

Dahmberg fails to overcome such shortcomings of the rejection based on Hawley in that Dahmberg also does not disclose or suggest: a low density slurry bridge mix including specified amounts of zirconium metal, potassium perchlorate oxidant, a thermal conductivity enhancer, such as aluminum or cupric oxide, and a binding agent and having a dry density of about 45% to about 65% of theoretical density.

While Dahmberg discloses a detonator such as including a fuse bridge and a primer, contrary to the assertion in the Action, Dahmberg does not disclose the use of a mixture of copper oxide and aluminum "with a bridge wire [sic]". Rather, Dahmberg discloses that "an alternately oxidizing and reducing material **in the fuse bridge**, such as copper oxide and aluminum" may be used to increase heat release from the bridge. (See Dahmberg, column 7, lines 24-31, emphasis added.) Moreover, Dahmberg discloses that the primers used therein may include known compositions for fuse heads, e.g., mixtures of oxides, chlorates, nitrates, aluminum, silicon, zirconium and binding agents deposited on top of the fuse bridge. (See Dahmberg, column 7, line 53 through column 8, line 7 and column 10, lines 50-64, for example.) Moreover, Dahmberg does not disclose or suggest including a thermal conductivity enhancer in a ZPP mixture having low density to increase the sensitivity of the ZPP mixture, to increase the NF rating without undesirably increasing the AF rating, to eliminate certain manufacturing steps such as are disclosed in the application and to reduce the costs of production by eliminating certain components of an initiator, as in the subject invention.

The further proposed combination of Ewick with Hawley and Dahmberg fails to overcome the above-identified shortcomings of Hawley and Dahmberg. While Ewick discloses a detonator including an ignition charge having

a density in the range of about 49% to about 65% of theoretical maximum density it does not disclose or suggest a low density slurry bridge mix including specified amounts of zirconium metal, potassium perchlorate oxidant, a thermal conductivity enhancer and a binder material. The lower densities of the ignitions charges disclosed in Ewick relate to ignitions charges preferably consisting essentially of "tetraamine-cis-bis (5-nitro-2H-tetrazole-N^2) cobalt (III) perchlorate (BCNP)" and having a particle size less than 10μm. (See Ewick, column 1, lines 46-51; column 6, lines 35-39 and column 7, lines 16-60, for example.) Ewick discloses that in order to offset the loss of sensitivity due to decreased compaction pressure the particle size of the BCNP is reduced. (See Ewick , column 7, lines 17-60 and Table 1.) Ewick does not show or suggest the inclusion of a thermal conductivity enhancer in a low density ZPP mixture to increase the sensitivity of the ZPP mixture, to increase the NF rating without undesirably increasing the AF rating, to eliminate certain manufacturing steps and to reduce the costs of production by eliminating no selected assembly components through the inclusion and use of the claimed low density slurry bridge mix.

Neither Hawley, Dahmberg or Ewick, alone or in combination, show or suggest a low density slurry bridge mix including about 25 to about 35 composition weight percent zirconium metal, about 10 to about 20 composition weight percent thermal conductivity enhancer, about 45 to about 65 composition weight percent

potassium perchlorate oxidant, and about 1.5 to about 5.0 composition weight percent binder material, said low density slurry bridge mix having a dry density of about 45% to about 65% of theoretical density, as required by claim 1.

Consequently, the rejections of claim 1 and claims 2-5 and 8-11 which are dependent, directly or indirectly, on claim 1, are overcome or otherwise believed not applicable and notification to that effect is solicited.

2. Claims 6, 7 and 12-21 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Hawley in view of Dahmberg and Ewick as applied to claims 1-5 and 8-11 above, and further in view of U.S. Patent 3,899,973 to Brocart (hereinafter "Brocart").

By the above, claim 7 has been rewritten in independent form to include all of the limitations of previous base claim 1. Claims 6 and 12-21 remain dependent, directly or indirectly on claim 1.

It is respectfully submitted that the further proposed combination of Brocart with Hawley in view of Dahmberg and Ewick fails to overcome the deficiencies of the rejections based on Hawley in view of Dahmberg and Ewick, such as identified and discussed above.

In view thereof, claims 6 and 12-21 are believed to be patentable thereover and notification to that effect is solicited.

3. Claims 22 and 23 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Hawley in view of Dahmberg, Ewick and Brocart.

The Action reiterates the above-identified assertions regarding the alleged disclosures of each of Hawley, Dhamberg, Ewick and Brocart. The Action further asserts that it would have been obvious to vary the amounts of the metals and oxidizers to achieve a desired result.

Claim 22 is an independent claim (with claim 23 dependent thereon) directed to a low density slurry bridge mix having adhesive properties effective to the density slurry bridge mix to an associated bridgewire including about 25 to about 35 composition weight percent zirconium metal, about 10 to about 20 composition weight percent aluminum metal thermal conductivity enhancer, about 48 to about 65 composition weight percent potassium perchlorate oxidant, about 10 to about 20 composition weight percent metal oxide supplemental oxidant and about 1.5 to about 5.0 composition weight percent acrylic binder, with the low density slurry bridge mix having a dry density of about 45% to about 60% of theoretical density.

Claim 22 includes at least all of the limitations of claim 7. Thus, as claim 7 is believed to be patentable over the combination of Hawley in view of Dahmberg, Ewick and Brocart, for at least the reasons advanced above, so too claim 22 and claim 23 (which is dependent thereon) are also believed to be patentable thereover and notification to that effect is solicited.

In view thereof and for at least the reasons advanced above, it is respectfully submitted that the proposed combination of Hawley in view of Dahmberg and Ewick and further in view of Brocart is inappropriate or ineffective to render claims 22 and 23 unpatentable and notification to that effect is solicited.

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Newly Added Claims

Claims 24-27 have been added. Claims 24-27 are dependent, directly or indirectly, on claim 7. As claim 7 is believed to be patentable over the prior art of record for at least the reasons advanced above, so too these claims which are dependent on claim 7 are also believed to be patentable over the prior art of record and notification to that effect is solicited.

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Conclusion

In view of the above, it is believed that all pending claims are in condition for allowance and notification to that effect is solicited. However, should the Examiner detect any remaining issues or have any questions, the Examiner is kindly requested to contact the undersigned, preferably by telephone, in an effort to expedite examination of the application.

Respectfully submitted,

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